

ASPECT – Autonomous Site Preparation: Excavation, Compaction, and Testing

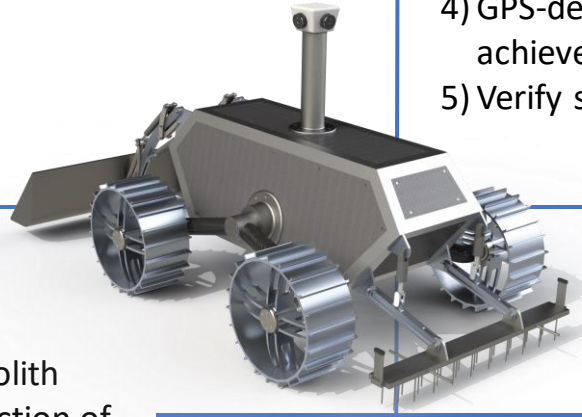
ASPECT Team

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ASPECT site preparation concept

Approach

ASPECT is a robotic system for regolith grading, rock removal, and compaction of the natural lunar surface. It is built around a Lunar Outpost 80 kg class rover and outfitted with specialized regolith manipulation devices, a regolith compaction device, and sensors. Vibration is used to reduce forces during regolith manipulation. A novel vibrating-pin-grid array compaction tool will compact the surface. Autonomy is enabled through integrated task and motion planning with redundant sensing for state estimation. On-site regolith simulant production is leveraged to create a high-fidelity testbed.

Development Objective

- 1) Push-button autonomy through a real-time task-to-motion planning approach for site preparation.
- 2) Develop multi-purpose regolith manipulation, grading, and rock removal that minimizes excavation forces.
- 3) Develop a low energy and contact-pressure compaction approach to enable 90% compaction to 30 cm depth.
- 4) GPS-denied robot and surface state estimation to achieve 1° and 1 cm-RMS over a 10 m diameter area.
- 5) Verify system and methods in an end-to-end system test. TRL 6 at conclusion of effort.

Impact and Infusion

The developed ASPECT system will enable landing site construction on the Moon for future Artemis missions and other landed lunar missions. The system is extendable to large site preparation tasks, including large landing pads, habitat site preparation, roads, and other structures on the lunar surface. Built around a Lunar Outpost rover that includes flight ready components. A path to a complete flight ready system will be identified.